Baltimore County
Office of Information Technology
Business Applications Unit
Geographic Information Systems

Cost Benefit
Geographic Information Systems

November 2001

Analysis of Impact of GIS to Baltimore County

Introduction

Geographic information system (GIS) technology has great potential to effect positive change on the business of local government. The majority, 80-90%, of the business county government conducts is geographically based. GIS technology is arguably one of the most important tools introduced to local government. GIS does however require significant funding for project initiation, operations and reoccurring maintenance.
In conducting interviews to obtain the metrics for this report, the question was asked, "What would be the impact if GIS were not available to your organization?" The following quote sums up the consensus of the agencies. "Without GIS you would have to double our technical support staff to achieve the same level of product."

The purpose of this analysis is to outline the costs and benefits associated with Baltimore County's GIS system in order to make better decisions on how to maintain the data and maximize the County's return on investment. It is important to note that these estimates reflect a high level review of the costs and benefits identified by OIT and the GIS users, and did not involve independent validation or process analysis.

Operations and Maintenance

GIS requires a significant resource allocation to maintain the data, applications and systems. The three main areas include personnel, hardware and software maintenance, and database maintenance. Additionally, some agencies require/have specialized staff and equipment to support their GIS utilization. Within OIT, the costs associated with GIS are as follows:

Existing Expenditures – Database Development and Operating Expenses

Personnel	348,988
Business Analyst	
Project Manager	
GIS Database Administrator (1)	
GIS Applications Programmer (1)	
GIS Quality Control Specialist (1)	
Interns	
Hardware Maintenance	
Servers	1,000
Workstations	1,500
Plotters	2,600
Software Maintenance	
AIX	4,600
ESRI (GIS Products)	42,400
Oracle	5,500
Software Upgrades (ESRI)	58,010
Supplies & Materials (Public Access)	5,400

Training & Travel	17,000
Contract Programming	250,000

Reoccurring Capital Expenditures

Database Maintenance (capital - increase 5% per year)	525,000
Workstation Replacement (3 year cycle X 3 per year)	6,300
Server Replacement (per year - 5 year replacement cycle)	30,000

Potential New Expenditures – Maintenance of Enterprise Databases and Applications Development

Personnel – New positions (not including benefits) 230,000

- 2 – Cadastral Mapping Technicians (@32,000 & 28,000)
- 1- Street Centerline Mapping Technician (@32,000)
- 1- Public Access Technician (@28,000)

Note: Providing additional personnel would eliminate the need for funding seven (7) GIS Intern positions. Only one (1) FTE GIS Intern position would be required.

Upgrades for GIS software are free for products included in the software maintenance agreement.

The planimetric/topographic database maintenance program requires between 1,600 and 5,022 hours per year to adequately perform quality control on the products received depending on the maintenance option. Interns supervised by the GIS Quality Control Specialist can perform quality control on the products. Maintaining the intern positions currently authorized would satisfy this requirement. The contract programming would be reduced or eliminated if the new Applications Programmer positions are funded.

Cadastral maintenance should have actually already begun for the areas that are on-line. There are approximately 3,500 updates annually to the cadastral database. In addition, a significant amount of resources is required to reconcile the original compilations from Phase I & II. Cadastral maintenance will require 4,000 – 5,000 hours annually.

Street centerline database maintenance requires one full-time individual. This position is critical for the ability for this database to be used in E911. Providing the street centerline data, CAD Geofile, in-house saves $60,000 currently paid to the Baltimore Metropolitan Council for this data. Without a dedicated individual, the County will probably need to continue to license the data from BMC for use in the E911 Center.

Additional resources will be required to meet the anticipated applications development requests. GIS technology is used in over 96 unique functional/application areas. Most of these areas could be automated with custom applications to further increase the efficiency of the agencies. GIS could use 2-3 more programmers to meet these demands.

Expenditures By Agencies Using GIS

Agencies using GIS with dedicated staff include PDM, DEPRM, OP and DPW. These agencies have a total of seven (7) full-time staff dedicated to working with GIS. There are additional individuals within each agency that utilize GIS on a full-time basis performing their assigned duties. Agency workstations will need to replace workstations on a similar basis to OIT. Approximately 8-10 workstations will require replacement annually, (cost $26,400 –$33,000) The agencies also spent approximately $5,400 per year on supplies for their plotters. These plotters would need to be replaced every six (6) years and cost approximately $9,000.

Impact of GIS on Workload and Projects

The following table highlights the financial impact on annual workload within county agencies. This table does not represent a complete cost benefit analysis of GIS but simply identifies significant work functions where GIS utilization has proved beneficial.

Table 1 - Annual Workload Savings (See Project Definitions)

Agency	Function	Savings
OP	Adequate Public Facilities	13,000
OP	Legislative Analysis	44,200
PDM	Lacquire Application	20,000
PDM	Rights-of-Way Inquires	11,700
OCC	Foreclosure Data Plotting	4,600
OCC	Mailing List Production	6,250
OCC	Property Value Research	5,400
DRP	Site Analysis Maps	72,250
DRP	Thematic Maps	17,500
DRP	Park Land Inventory	5,000
DRP	Open Space/Park Land Analysis	17,500
DPW	Alley Reconstruction	15,000
DPW	Road Take-Overs	3,500
DPW	Curb & Gutter	1,200
DPW	Water and Sewer Administration	97,000
DPW	Preliminary Design	158,550
DPW	Drainage Complaints	6,000
DPW	Flood Plain Investigation	35,000
DPW	Property Analysis	16,250
DPW	Building Permit Review	6,750
DPW	Basic Services Maps	9,800
DPW	Traffic Engineering	34,350
DED	Marketing Analysis	5,000
	Total	605,800

A reoccurring theme stated by the agencies using GIS is that many of the benefits are intangible and are not easily measured. GIS provides access to current data that can be overlayed on multiple data sets providing up-to-date and comprehensive analysis. Agencies also identified specific projects and programs that GIS played an important role in the success or funding. The following table provides savings estimates for specific projects.

Table 2 - Project Specific Savings

Agency	Program/Application		Savings
DEPRM	Watershed Management Plan		360,000
DEPRM	Development Review		156,000
DEPRM	Rural Legacy (3 years)		1,220,000
DEPRM	Agricultural Preservation		300,000
DEPRM	NPDES Permit		268,800
DEPRM	Grants		100,000
OP	CZMP		643,700
OP	Master Plan		353,600
		Total	3,402,100

In addition to the project specific benefits, the Department of Planning stated that to maintain the current level of products and services, they would need an additional twelve (12) technical staff. The Department of Economic Development attributes $28,235,845 of capital investment within the county is directly related to GIS.

Additionally, the ability to use GIS to access information and respond to inquiries (citizen, state, federal etc.) may have one of the largest impacts on county operations. This benefit, while being difficult to measure, allows the county to be more effective, respond faster and with more accurate information, thereby reducing the resources required to provide the information requested.

Future Strategy

During the next 12-18 months, the county should realize a significant increase in GIS utilization. (Table 2 highlights functional/application areas already using GIS.) With the completion of the original capital project; the planimetric/topographic, cadastral (parcel), zoning, utilities and street centerline map databases will be available on on-line for use by county agencies and departments.

OIT will be conducting requirements analysis for departments and agencies using GIS to determine the prioritization of applications development and data modernization. Work is in progress to deploy an application for utilities management. The cost benefit for this application identifies $107,000 in potential saving annually.

The County will need to make a firm commitment for the continued maintenance of the databases with additional staff for GIS and capital funding for the system to remain viable. An example of the impact the lack of maintenance has on a database is highlighted in Harford County's recent decision to abandon their existing planimetric/topographic database and reacquire a new product. The cost to Baltimore County to produce a new planimetric/topographic database would be approximately $6,000,000.

The County has already purchased and is prototyping internet mapping applications using ArcIMS. ArcIMS will allow greater access to the GIS and databases through the internet. Access through the internet has the potential to eliminate or reduce "public" copies of maps and reports reposited with the libraries.

Small scale and county-wide databases will need to be reviewed for completeness, accuracy, currency and fit to the large-scale databases. Additional databases will be developed for enterprise or project specific applications.

Table 3 - GIS Application Matrix – Current Functions

Functional Area/Program	DEPRM	OP	DPW	PDM	DED	OCC	DRP	COUNT
Accident Location Analysis				X				1
Address Matching	X	X	X	X	X	X		6
Address Validation for Data Entry				X		X		2
Adequate Public Facilities			X		X			2
Agriculture Preservation	X	X						2
Alley Reconstruction			X					1
Approved Development Locations		X			X			2
Assessor Cards (Record Plats) Scanned				X	X			2
Basic Services Mapping			X				X	2
Bridge Inventory and Inspections			X	X				2
Building Permit Review			X					1
Bulk Trash Routing			X					1
Cadastral (Property) Map Preparation Updates				X				1
Capital Project Management	X	X	X	X	X		X	6
Commercial Land Inventory					X			1
Commercial Properties Real Estate Database					X			1
Communication Tower Locations		X						1
Complaint Tracking and Response	X		X	X				3
Conservation Master Plan Management	X			X	X			3
County Water and Sewer Master Plan Mapping			X	X	X			3
County-Owned Structures/Space Inventory			X	X				2
Crime Analysis					X			1
Critical Area Analysis	X							1
Curb/Gutter Conditions/Repair/Permits			X					1
CZMP Application		X	X				X	3
Data Distribution Applications			X		X		X	3
Data Maintenance Applications		X	X	X				3
Data Quality Control Applications			X	X	X			3
Data Query and Display Application	X	X	X	X	X	X	X	7
Demographic Analysis		X	X		X	X	X	5
Detour Plans			X					1
Development Review and Tracking	X	X	X	X				4
Districting		X	X	X			X	4
Down Zoning	X	X						2
Drainage Complaint Investigation			X					1
Easement Mapping	X							1
Economic Development Site Selection	X	X			X			3

Functional Area/Program	DEPRM	OP	DPW	PDM	DED	OCC	DRP	COUNT
Engineering Design/Studies			X					1
Enterprise Zones		X	X		X			3
Environmental Investigation Review	X						X	2
Facilities Management	X		X					2
Flood Control/Inspections			X					1
Floodplain Analysis	X		X	X				3
Forest Management Plan	X							1
Future Water, Sewer, Storm Drain, Roads and Water Tank Mapping			X		X			2
Grinder Pump Locations			X					1
Growth Management	X	X	X		X		X	5
Gunpowder Watershed Ecological Model	X							1
Hazmat Tracking	X							1
Hydrologic Modeling (HSPF & SWMM)	X		X					2
Internet Site Posting		X					X	2
Investigation of Surplus Property		X		X				2
Lacquire				X				1
Land Acquisition Databases				X			X	2
Land Use Analysis	X	X	X			X	X	5
Landfills and Recycling Facilities Management	X		X					2
Legislative Analysis			X		X			2
Management of the Chesapeake Bay Program	X							1
Master Planning	X	X	X		X	X	X	6
Master Roads Inventory/Street Segment Integration			X	X	X	X		4
MD 43 Extended		X	X		X		X	4
NPDES Stormwater Management	X		X					2
Nutrient Reduction Strategies	X							1
Open Space Analysis	X	X				X	X	4
Park Development Siting	X	X					X	3
Patron Analysis					X			1
Pavement Cuts Permits			X					1
Pavement Marking Inventory (Re-stripping)			X					1
Preliminary Alignment Studies			X					1
Property Analysis	X	X	X	X	X	X	X	7
Public Access		X	X	X			X	4
Public Works Maintenance			X					1
Repaving Support			X				X	2
Reservoir Profiles	X		X					2
Rights-of-Way Fee/Maintenance				X				1
Routing			X				X	2

Functional Area/Program	DEPRM	OP	DPW	PDM	DED	OCC	DRP	COUNT
Rural Legacy	X	X					X	3
School Location Mapping		X	X				X	3
Shoreline Land Use Study	X						X	2
Sidewalk Inventory/Repair			X					1
Signal Inventory/Design		X	X					2
Site Analysis/Plan Development	X	X	X	X	X		X	6
Smart Growth	X	X			X	X	X	5
Snow Removal/Routing/Issues			X					1
Solid Waste Collection Routes	X		X		X			3
Standardized Map Production	X	X	X	X	X	X	X	7
Storm Drain Culvert Studies			X					1
Street Naming				X		X		2
Street Sign Inventory			X					1
Street Sweeping Routing	X		X					2
Streetscapes Investigation		X	X		X			3
Study Area Maps	X	X	X		X	X	X	6
Traffic Calming			X					1
Truck Traffic Routing			X					1
Utilities Key Sheet Mapping			X					1
Utilities Maintenance Programming			X					1
Utilization of Planimetric/Topographic Map in Lieu of Surveys			X					1
Vacant Land Analysis	X	X			X		X	4
Water and Sewer Amendment Process		X	X					2
Water and Sewer Pumping Stations	X		X		X			3
Water Quality Monitoring	X		X					2
Watershed Planning/Management	X	X						2
Work Order Management			X					1
Zoning Hearing Case Development and Analysis				X	X			2
Zoning Layer		X			X			2
Zoning Review Cases		X			X			2
Applications of GIS per Agency	41	37	68	28	35	13	28	

Project Definitions

The narratives below provide additional data to support the information in Table 1 - Annual Workload Savings. The departments provided the hours identified as saved. The savings are a direct result of using GIS technology in place of previously used manual procedures. Unless specifically stated, the total savings is based on the last twelve months of production.

Adequate Public Facilities – The **Office of Planning** performs analysis of development activity for Adequate Public Facilities impact. The Office of Planning saves 5 hours per week for analyzing and responding to requests for APF determinations. **Total savings 260 hours.**

Legislative Analysis – The **Office of Planning** uses GIS to perform analysis for impacts of proposed legislation. Examples of legislation that GIS is used to analyze include water extensions, adult entertainment and day care facilities. **The saving was over the past 12 months for using GIS was 884 hours.**

Lacquire Application – The Office of Information Technology, Business Applications/GIS developed a custom application for The **Department of Permits and Development Management, Land Acquisition**. The application was designed to automate property identification and notification process. **Land Acquisition has saved 400 hours** of staff time based on research of 800 properties.

Rights-of-Way Inquiries – The **Department of Permits and Development Management** uses GIS to assist in making determinations on ownership of road rights-of-ways. Use of GIS saves approximately 10 minutes for processing each inquiry. Based on an average of 1400 requests per year, resulting in an estimated **annual savings of 234 hours**.

Foreclosure Data Plotting – The **Office of Community Conservation** uses GIS to address match properties that have undergone foreclosure. GIS is used to plot these properties to identify patterns in house foreclosures allowing for better analysis and intervention. This activity saved 10 minutes per address for 550 points. **Total savings 92 hours.**

Mailing List Production – The **Office of Community Conservation** uses GIS to automate mailing list generation. The use of GIS saves 45 seconds per address to generate a mailing list. The annual activity is 10,000 items**. Total annual savings 125 hours.**

Property Value Research – The **Office of Community Conservation** uses GIS to analyze the property values of a large geographic area more efficiently and effectively. The annual saving is based on 5 minutes saved for locating 1300 properties on the map for analysis. **Total savings 108 hours**.

Site Analysis Maps – The **Department of Recreation and Parks** produces maps using GIS to analyze various park sites. These maps combine existing with newly created data to analyze park sites. The department produced 85 maps with a savings of 17 hours for each map. **Total savings 1445 hours**.

Thematic Maps – The **Department of Recreation and Parks** produces maps for specific themes. The department produced 50 maps with a savings of 7 hours for each map. **Total savings 350 hours.**

Park Land Inventory – The **Department of Recreation and Parks** uses GIS to maintain and manage the park land inventory for the county. The automation of this inventory allows for faster retrieval of this information. The department **saves 100 hours of research time per year.**

Open Space/Park Land Analysis – The **Department of Recreation and Parks** uses GIS to analyze development plans with regard to opens space. GIS allows analysis to be performed incorporating existing sites from the park land inventory. **Using GIS saves 350 hours per year.**

Alley Reconstruction – The **Department of Public Works** uses GIS data to analyze ally reconstruction projects. The GIS data is more accurate, current, and complete compared to previously existing data, which allows for easier and more efficient analysis of project areas. The department has approximately 150 projects per year. Using GIS saves each project 2 hours. **Total savings 300 hours**.

Road Take-Overs – The **Department of Public Works** uses GIS data to review road take-overs saving 14 hours per project. The GIS data is more accurate, current, and complete compared to previously existing data, which allows for easier and more efficient analysis of project areas. A minimum of five projects are done each year. **Total savings 70 hours**.

Curb & Gutter – The **Department of Public Works** uses GIS analyze curb & gutter petitions. The GIS data is more accurate, current, and complete compared to previously existing data, which allows for easier and more efficient analysis of project areas. Six hours are saved on 3-5 projects per year. **Total average savings 24 hours.**

Water and Sewer Administration – The **Department of Public Works saves 1940 hours** annually analyzing and developing projects related to water and sewer administration. Products produced using manual processes required considerable more resources. The workload is this area has not increased but been made more efficient. Typical products include updates to the master plans and reviewing extensions.

Preliminary Design – The **Department of Public Works** saves **approximately 3171 hours** using GIS data and applications in preliminary project design. The data produced for GIS allows preliminary design to be accomplished without additional mapping or survey work. The GIS data is more accurate, current, and complete compared to

previously existing data, which allows for easier and more efficient analysis of project areas. GIS data reduces the number of jobs requiring additional survey fieldwork.

Drainage Complaints – The **Department of Public Works** uses GIS respond to drainage complaints by reducing the fieldwork necessary to respond to a complaint. Using GIS to investigate these complaints **saves 120 hours per year**.

Flood Plain Investigations – The **Department of Public Works** uses GIS to analyze approximately 200 requests for Letters of Map Amendments (LOMA) or Letters of Determination Requests (LODR). A custom GIS application was developed to support this activity. **Total savings 700 hours.**

Property Analysis – The **Department of Public Works** uses GIS to access property information. This information includes items such as land area, ownership, legal descriptions, liber & folio. The department saves 4 hours of resources for each property accessed. The department investigates over 1300 properties per year**. Total savings 325 hours.**

Building Permit Review – The **Department of Public Works** uses GIS data to perform analysis related to reviewing building permit applications. Using GIS saves 1.5 hours per application. DPW analyzes approximately 90 requests annually. **Total savings 135 hours.**

Basic Service Maps – The **Department of Public Works** uses GIS to maintain and generate these basic service maps for water and sewer. Using GIS **saves a minimum of 196 hours** to update and produce the maps per year.

Traffic Engineering – The **Department of Public Works** uses GIS for analysis related to traffic calming projects, road closures, detour plan and block party road closures. The department processed over 200 projects in the past 12 months that resulted in a **savings of 687 hours.**

Marketing Analysis – The **Department of Economic Development** uses GIS as a marketing tool to analyze sites for clients. Over 50 projects have resulted in **100 hours of savings.**

In-Source Alternative Costs

Year		1	2	3	4	5	6	7	8	9	10
Benefits											
Public Access		38,776	39,939.28	41,137.46	42,371.58	43,642.73	44,952.01	46,300.57	47,689.59	49,120.28	50,593.88
In-Kind Data Access [1]		40,787	42,010.61	43,270.93	44,569.06	45,906.13	47,283.31	48,701.81	50,162.87	51,667.75	53,217.78
Agency Applications											
OP	Adequate Public Facilities	13,000									
OP	Legislative Analysis	44,200									
PDM	Lacquire Application	20,000									
PDM	Rights-of-Way Inquiries	11,700									
OCC	Forclosure Data Plotting	4,600									
OCC	Mailing List Production	6,250									
OCC	Property Value Research	5,400									
DRP	Site Analysis Maps	72,250									
DRP	Thematic Maps	17,500									
DRP	Park Land Inventory	5,000									
DRP	Opens Space/Park Land Analysis	17,500									
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DPW	Flood Plain Investigation	35,000									
DPW	Property Analysis	16,250									
DPW	Building Permit Review	6,750									
DPW	Basic Services Maps	9,800									
DPW	Traffic Engineering	34,350									
DED	Marketing Analysis	5,000									
MISC.	NEC benefits	436,420									
Annual Agency Benefits		***1,042,220***	***1,073,487***	***1,105,691***	***1,138,862***	***1,173,028***	***1,208,219***	***1,244,465***	***1,281,799***	***1,320,253***	***1,359,861***
Total		**1,121,783**	**1,155,436**	**1,190,100**	**1,225,803**	**1,262,577**	**1,300,454**	**1,339,468**	**1,379,652**	**1,421,041**	**1,463,672**
Costs											
Maintenance											
Hardware Maintenance											
	Servers	1,000	1,030	1,061	1,093	1,126	1,159	1,194	1,230	1,267	1,305
	Workstations	1,500	1,545	1,591	1,639	1,688	1,739	1,791	1,845	1,900	1,957
	Plotters	2,600	2,678	2,758	2,841	2,926	3,014	3,105	3,198	3,294	3,392
Hardware Replacement											
	Workstation replacement	6,300	6,489	6,684	6,884	7,091	7,303	7,523	7,748	7,981	8,220
	Server Replacement	150,000	-	-	-	-	150,000	-	-	-	-
Software Maintenance											
	AIX	4,600	4,738	4,880	5,027	5,177	5,333	5,493	5,657	5,827	6,002
	ESRI	58,010	42,400	43,672	44,982	46,332	47,722	49,153	50,628	52,147	53,711
	Oracle	5,500	5,665	5,835	6,010	6,190	6,376	6,567	6,764	6,967	7,176
Other											
	Supplies & Materials	5,400	5,562	5,729	5,901	6,078	6,260	6,448	6,641	6,841	7,046
	Training & Travel	17,000	17,510	18,035	18,576	19,134	19,708	20,299	20,908	21,535	22,181
Data Maintenance											
Cadastral											
	Labor (hours)	8,941	6,295	6,295	3,000	3,000	3,000	3,000	3,000	3,000	3,000
	Labor (cost)	151,729	111,633	116,657	58,097	60,711	63,443	66,298	69,281	72,399	75,657
	Contractual	100,000									
Plan/Topo											
	Labor (hours)		800	800		800	800		800	800	
	Labor (cost)		14,254	14,895		16,266	16,998		18,562	19,397	
	Contractual		200,000	200,000		200,000	200,000		200,000	200,000	
Orthophotography											
	Labor (hours)	650			650			650			650
	Labor (cost)	11,083			12,647			14,432			16,470
	Contractual	650,000	-	-	650,000	-	-	650,000	-	-	650,000
Centerline											
	Labor (hours)	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680
	Labor (cost)	30,408	31,776.36	33,206.30	34,700.58	36,262.11	37,893.90	39,599.13	41,381.09	43,243.24	45,189.18
	Contractual										
Other Layers											
	Labor (hours)	1,482	1,482	1,482	1,482	1,482	1,482	1,482	1,482	1,482	1,482
	Labor (cost)	12,597	13,164	13,756	14,375	15,022	15,698	16,405	17,143	17,914	18,720
	Contractual										
Wages		194,598	202,382	210,477	218,896	227,652	236,758	246,229	256,078	266,321	276,974
Operating Budget Requirements		**502,324**	**460,826**	**479,237**	**431,669**	**451,655**	**469,405**	**484,535**	**507,064**	**527,033**	**544,001**
Capital Budget Requirements		**900,000**	**200,000**	**200,000**	**650,000**	**200,000**	**350,000**	**650,000**	**200,000**	**200,000**	**650,000**
Total Annual Expenditures		**1,402,324**	**660,826**	**679,237**	**1,081,669**	**651,655**	**819,405**	**1,134,535**	**707,064**	**727,033**	**1,194,001**
Net Gain (Loss)		***(280,541)***	***494,610***	***510,862***	***144,134***	***610,922***	***481,049***	***204,933***	***672,587***	***694,008***	***269,672***
NPV		$2,876,825.27									
IRR		168%									

1License value of data provided to contractors as a component of the County's responsibilities for construction and other related contracts.

Year	1	2	3	4	5	6	7	8	9	10
Benefits										
Public Access	38,776	39,939.28	41,137.46	42,371.58	43,642.73	44,952.01	46,300.57	47,689.59	49,120.28	50,593.88
In-Kind Data Access [1]	40,787	42,010.61	43,270.93	44,569.06	45,906.13	47,283.31	48,701.81	50,162.87	51,667.75	53,217.78
Agency Applications										
OP Adequate Public Facilities	13,000									
OP Legislative Analysis	44,200									
PDM Lacquire Application	20,000									
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DPW Property Analysis	16,250									
DPW Building Permit Review	6,750									
DPW Basic Services Maps	9,800									
DPW Traffic Engineering	34,350									
DED Marketing Analysis	5,000									
MISC. NEC benefits	436,420									
Annual Agency Benefits	***1,042,220***	***1,073,487***	***1,105,691***	***1,138,862***	***1,173,028***	***1,208,219***	***1,244,465***	***1,281,799***	***1,320,253***	***1,359,861***
Total	**1,121,783**	**1,155,436**	**1,190,100**	**1,225,803**	**1,262,577**	**1,300,454**	**1,339,468**	**1,379,652**	**1,421,041**	**1,463,672**
Costs										
Maintenance										
Hardware Maintenance										
Servers	1,000	1,030	1,061	1,093	1,126	1,159	1,194	1,230	1,267	1,305
Workstations	1,500	1,545	1,591	1,639	1,688	1,739	1,791	1,845	1,900	1,957
Plotters	2,600	2,678	2,758	2,841	2,926	3,014	3,105	3,198	3,294	3,392
Hardware Replacement										
Workstation replacement	6,300	6,489	6,684	6,884	7,091	7,303	7,523	7,748	7,981	8,220
Server Replacement	150,000	-	-	-	-	150,000	-	-	-	-
Software Maintenance										
AIX	4,600	4,738	4,880	5,027	5,177	5,333	5,493	5,657	5,827	6,002
ESRI	58,010	42,400	43,672	44,982	46,332	47,722	49,153	50,628	52,147	53,711
Oracle	5,500	5,665	5,835	6,010	6,190	6,376	6,567	6,764	6,967	7,176
Other										
Supplies & Materials	5,400	5,562	5,729	5,901	6,078	6,260	6,448	6,641	6,841	7,046
Training & Travel	17,000	17,510	18,035	18,576	19,134	19,708	20,299	20,908	21,535	22,181
Data Maintenance										
Cadastral										
Labor (hours)	8,941	2,560	2,560	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Labor (cost)	151,729	45,398	47,441	23,239	24,284	25,377	26,519	27,713	28,960	30,263
Contractual	100,000	405,000	405,000	60,750	60,750	60,750	60,750	60,750	60,750	60,750
Plan/Topo										
Labor (hours)		800	800		800	800		800	800	
Labor (cost)		14,254	14,895		16,266	16,998		18,562	19,397	
Contractual		200,000	200,000		200,000	200,000		200,000	200,000	
Orthophotography										
Labor (hours)	650			650			650			650
Labor (cost)	11,083			12,647			14,432			16,470
Contractual	650,000	-	-	650,000	-	-	650,000	-	-	650,000
Centerline										
Labor (hours)										
Labor (cost)										
Contractual	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
Other Layers										
Labor (hours)	1,482	1,482	1,482	1,482	1,482	1,482	1,482	1,482	1,482	1,482
Labor (cost)	12,597	13,164	13,756	14,375	15,022	15,698	16,405	17,143	17,914	18,720
Contractual										
Wages	194,598	202,382	210,477	218,896	227,652	236,758	246,229	256,078	266,321	276,974
Operating Budget Requirements	**471,916**	**362,815**	**376,815**	**362,110**	**378,966**	**393,445**	**405,157**	**424,114**	**440,350**	**453,417**
Capital Budget Requirements	**960,000**	**665,000**	**665,000**	**770,750**	**320,750**	**470,750**	**770,750**	**320,750**	**320,750**	**770,750**
Total Annual Expenditures	**1,431,916**	**1,027,815**	**1,041,815**	**1,132,860**	**699,716**	**864,195**	**1,175,907**	**744,864**	**761,100**	**1,224,167**
Net Gain (Loss)	***(310,133)***	***127,622***	***148,284***	***92,942***	***562,860***	***436,259***	***163,561***	***634,787***	***659,941***	***239,505***
NPV	$1,979,500.47									
IRR	64%									

1License value of data provided to contractors as a component of the County's responsibilities for construction and other related contracts.

	Hours	Admin	Task Hours	Gen'l Maint	Task Hours	Cadastral	Task Hours	Plan/ Topo	Task Hours	Street Centerline	Task Hours	Other Layers	Task Hours	Public Access	Task Hours
Business Analyst	1820	1.00	1820		0		0		0		0		0		0
Project Manager	1820	0.60	1092	0.15	273	0.25	455		0		0		0		0
GIS Database Administrator	1768	0.20	354	0.80	1414		0		0		0		0		0
GIS Applications Programmer	1768	0.10	177	0.90	1591		0		0		0		0		0
GIS Quality Control Specialist	1768		0		0	0.25	442	0.25	442	0.15	265	0.15	265	0.20	354
Interns	1560		0		0	0.95	1482		0		0		0	0.05	78
Cadastral Mapping Technician (2)	3536		0		0	0.95	3359		0		0		0	0.05	177
Street Centerline Technician	1768		0		0		0		0	0.95	1680		0	0.05	88
Public Access Technician	1768		0		0		0		0		0		0	1.00	1768
Totals	17576	1.90	3442	1.85	3279	2.40	5738	0.25	442	1.10	1945	0.15	265	1.35	2465

Administration includes activities from SDLC Phases 1-3 & 6, Project Management, Scheduling, Writing RFP's, contract administration
General Maintenance includes activities from SDLC Phases 4&5, database administration, programming, ArcSDE loading & tuning
Cadastral, planimetric/topographic, street centerline and other layers includes the activities of compilation or maintenance.

	Hours Available	Hours Worked									
		1	2	3	4	5	6	7	8	9	10
Business Analyst	1,820.00										
Project Manager	1,820.00										
GIS Database Administrator	1,768.00										
GIS Applications Programmer	1,768.00										
GIS Quality Control Specialist	1,768.00	650	800	800	650	800	800	650	800	800	650
Interns	1,560.00	1482	1482	1482	1482	1482	1482	1482	1482	1482	1482
Cadastral Mapping Techs (2)	3,536.00	8941	6295	6295	3000	3000	3000	3000	3000	3000	3000
Street Centerline Tech	1,768.00	1680	1680	1680	1680	1680	1680	1680	1680	1680	1680
Public Access Tech	1,768.00										

Business Analyst	1,820.00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Project Manager	1,820.00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
GIS Database Administrator	1,768.00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
GIS Applications Programmer	1,768.00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
GIS Quality Control Specialist	1,768.00	37%	45%	45%	37%	45%	45%	37%	45%	45%	37%
Interns	1,560.00	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Cadastral Mapping Techs (2)	3,536.00	253%	178%	178%	85%	85%	85%	85%	85%	85%	85%
Street Centerline Tech	1,768.00	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Public Access Tech	1,768.00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%